Ohio Agricultural Experiment Station.

BULLETIN 112.

WOOSTER, OHIO, DECEMBER, 1899.

THE CLOVER ROOT BORER.

The Bulletins of this Station are sent free to all residents of the State who request them. Persons who desire their address changed should give both old and new address. All correspondence should be addressed to

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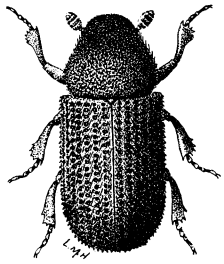

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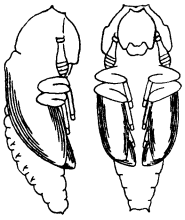

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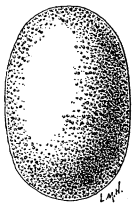

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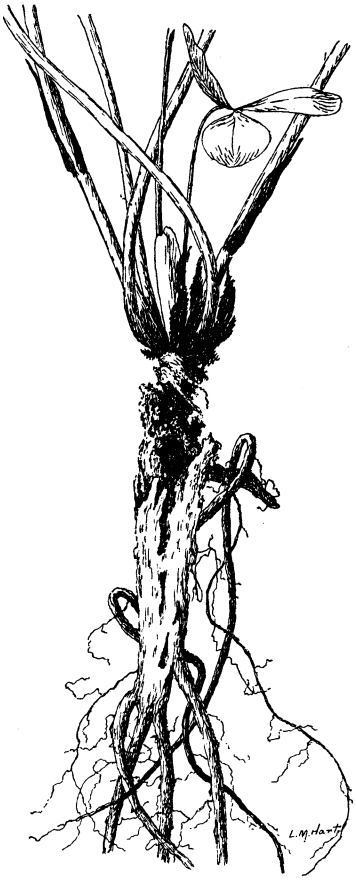

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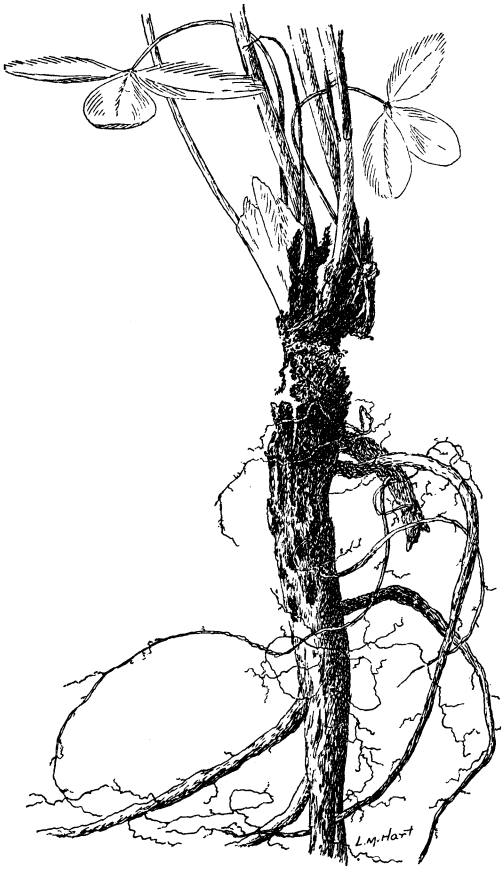

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Plate showing the Clover Root Borer in its different stages of development and the appearance of infested clover roots.

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BULLETIN

OF THE

Ohio Agricultural Experiment Station.

NUMBER 112. DECEMBER, 1899.

THE CLOVER ROOT BORER.

Hylastes obscurus Marsham.

Ord. COLEOPTERA. Fam. SCOLYTIDÆ.

PLATE XI.

BY F. M. WEBSTER.

This is a foreign insect that has come to us probably within the last fifty years, having been first discovered in this country in 1878. The native home of the insect is in middle Europe, where its depredations on red clover have been known for many years, one of the best treatises on its life and habits having been published as early as 1844.* Just when or how it came to be introduced into this country is not known, but it has spread from New York westward, at least as far as Indiana and Michigan. In Ohio it appeared, first, over the northern portion of the State, then in the southwest corner, and is at present generally diffused over the entire State. It has been sent me from Summit county, where it attacked growing peas.

The life history of the pest is probably the same all over Ohio, though it may pass the winter at the extreme south wholly in the adult state, while in the northern part it does this to a large extent, yet may winter over in all stages. The eggs are laid during May and June, in cavities gouged out by the female in the crown of the plant in which she places from four to six pale, whitish, elliptical eggs. These hatch in about a week, the young grubs for a time feeding in the excavation made by the mother insect, but they soon begin to burrow downward, finally making their way to the different branches, the galleries running nearly regularly along the axes of the roots.

*Stettiner Ent. Zeit., 1844, pp. 389-397.

DIFFERENT STAGES OF THE INSECT DESCRIBED.

The fully developed insect is a brownish-black beetle about one-eighth of an inch long and is shown, enlarged, in Fig. 1, Plate XI. The young, or grub, Fig. 2, when full grown is nearly as long as the beetle, of a white color, with yellowish head and dark-brown jaws. The pupa, or the stage between the grub and the beetle, is shown also enlarged at Fig. 3. The egg is very minute and white in color, shown in Fig. 4. Figs. 5 and 6 show effect of insect on roots.

HABITS OF THE INSECT.

The beetles lay their eggs in the plants, as previously stated, and these hatch into grubs, which when fully grown change to pupæ and from these to the beetles. There is but one generation each year and the following table, based largely on observations made during the last four years by Mr. C. W. Mally, at Wooster, Ohio, under my directions, will show the stage in which they may be found in the roots during the entire year.

Month.	Day.	Year.	Eggs (Fig. 4).	Larva (Fig. 2).	Pupa (Fig. 3).	Adult (Fig. 1).	Month.	Day.	Year.	Eggs (Fig. 4).	Larva Fig. 2).	Pupa (Fig. 3).	Adult (Fig. 1).
Jan	14	1899	....	X	....	X	June	20	1899	X	X	....	X
March ..	2	1899	....	....	X	X	June	20	1898	....	X	....	....
March ..	8	1898	....	X	....	X	June	25	1898	....	X	....	....
March ..	21	1898	....	X	....	X	July	6	1896	....	X	X	X
March ..	22	1899	....	X	....	X	July	7	1899	....	X	X	....
April ...	8	1898	....	X	....	X	July	12	1898	....	X	X	....
April ...	26	1899	....	....	....	X	July	18	1896	....	X	X	....
April ...	30	1898	....	X	....	X	Aug	4	1896	....	X	....	X
May	3	1899	....	....	....	*X	Aug	10	1899	....	X	X	X
May	10	1897	....	....	....	X	Aug	18	1897	....	X	X	X
May	17	1898	X	X	....	X	Aug	21	1896	....	X	X	X
May	18	1899	....	....	....	X	Aug	26	1898	....	X	X	X
May	23	1898	X	X	....	X	Sept	20	1899	....	X	X	X
May	25	1899	....	....	....	X	Oct	5	1896	....	....	....	X
May	27	1898	X	X	....	X	Oct	14	1899	....	X	X	X
May	30	1896	....	X	....	X	Oct	24	1898	....	X	X	X
May	31	1898	X	X	X	X	Nov	10	1899	....	X	....	X
June	2	1899	X	....	....	X	Nov	15	1899	....	....	....	X
June	2	1896	X	X	....	X	Nov	17	1896	....	....	....	X
June	8	1898	X	†X	....	X	Nov	17	1899	....	X	X	X
June	15	1896	X	X	....	X	Nov	24	1897	....	X	....	X
June	19	1896	X	X	....	X	Nov	29	1899	....	X	....	X

* Obtained by sweeping clover plants. † Very young.

These records show that, at the beginning of the year, hibernating adults Fig. 1 and larvæ Fig. 2 were present but, rarely, a pupa, Fig. 3, which condition continues until May 17th, when the first eggs were found; making the first addition for the season. The pupæ, recorded on March 2nd and May 31st, came from the hibernating larvæ, and indicate approximately when these hibernating larvæ transform. The finding of young larvæ on June 8th, indicates, approximately, when the new brood of larvæ begins work. The almost total absence of adults from the last week in June to the first week in August, indicates the time between the last adults of one brood and the first adults of the other. From that time on until about Nov. 1st, all stages were found, but after that generally only adults and larvæ, and the latter not common, which represents the winter condition. We naturally expected to find an occasional hibernating pupa, but in no case was a pupa actually found, although we searched as carefully as possible. It seems probable that this condition is due to the influence of decreased temperature, which is sufficient to retard the partly developed larvæ, and still high enough to permit the transforming of the pupa. The insect does not attack the young clover, the first year after it is sown, but that which is growing the second year from the seed, and the injury is done, very largely at least, before the first of August. If the attack is very severe the field will show the effect of the work of the insect soon after the hay crop is removed, by the plants dying out in spots, and on examination, the roots will be found as shown in Figs. 5 and 6, which were drawn to show the opposite halves of the same plant.

PROBABLE COURSE OF DIFFUSION IN OHIO.

The insect, as I have stated, was imported from Europe, its ravages being first observed in Central Western New York in 1878, and in Ohio about twelve years later. So far as can be determined it first appeared in this State in the extreme northeastern section. While its progress across the northern part of the State, where it also attacked peas as well as clover, was being noted, my source of information being largely reports accompanied by specimens from farmers, one of these reports was unexpectedly received from southeastern Indiana, a direction almost directly opposite from where it had already occurred in Ohio. From material received from correspondents and from personal observations, I am led to believe that it was washed into the upper tributaries of the Ohio river and left along its course by the falling stream, thus becoming established in southeastern and southern Ohio, the outbreak in Dearborn county, Indiana, originating from adults carried into the lowlands about the mouth of the Big Miami river and below. From this point it made its way north and eastward into Ohio, meeting the south-bound tide of diffusion probably in or near Mercer county, but leaving a central area to be occupied later by the slow but steady advance of the species now from other directions.

The species had been reported from extreme southeastern Michigan as early as 1889, the introduction here being attributed to specimens having probably been brought across Lake Erie by the winds from some eastern locality. A year later a few specimens were found at Lansing, but it was not until 1892 that it began to make its presence felt, and then only over a strip of country extending from Monroe to Grand Rapids. As the insect was abundant enough in Paulding county, Ohio, to work serious injury to the clover crop in 1893, I am disposed to doubt the above mentioned theory of first introduction into southeastern Michigan by way of Lake Erie, and to ascribe it to a continuation of the Ohio invasion. This seems all the more probable, as it would be only after the insect had become seriously injurious that information would be likely to reach me through farmers, and the pioneers might be and probably were several years in advance of this. A year later, in 1894, came the reports from Mercer county, Ohio, which might have been due to the southern diffusion of the northern Ohio and southern

Map showing probable course of diffusion of Clover Root Borer in Ohio.

Michigan invasion, but the outbreak in Dearborn county, Indiana, could not be accounted for in the same way, and this must, therefore, be attributed to a separate introduction, for which there appears to be no other explanation than that the species was carried down the Ohio river and left stranded in the lowlands in that section.

Besides this, both correspondence and personal observations show that the species became noticeably numerous in eastern Ohio before it did in the central portion of the State. It was not until 1896 that it was observed on the Experiment Station grounds at Wooster, which is slightly over 85 miles in a direct line from Columbus, and slightly over 50 miles, also in a direct line, from Cleveland.

PREVENTIVE MEASURES.

The larvæ or grubs are footless and cannot travel about from plant to plant, but must either find subsistance within the plant or perish, unless they are sufficiently advanced to enable them to enter the pupal state, during which they require no food. It is the custom in many localities to remove but one crop of hay, pasturing the field later on and plowing it up the following spring. This allows the borers to develop within the plants, and they have but to make their way to adjoining fields and commence their work the following spring. Therefore, as a preventive, the farmer's best course is to plow this field, if badly injured by this pest, as soon as possible after the middle of June, taking care to leave the sod exposed to the drying out effects of the weather as much as possible. Of course this does not admit of removing a crop of seed, but if the plan is followed in a community for a few years, or if only healthy fields are carried over, the pest will probably become so reduced as not to long require such rigid treatment. It is impossible to prevent the full grown insects from entering a field, if they are in the near vicinity, and equally impossible to prevent them from ovipositing in the plants, after they have become established, while to reach the pest in the roots is out of the question. What has always appeared to me to be the better plan is to plow infected fields immediately after the hay crop has been removed, while the larvæ are in a helpless condition. If the sod is turned up to the hot sun and winds, it will soon dry out and wither the roots so that the food supply of the larvæ will be cut off and they must necessarily starve; whereas, if the plowing is delayed until they have reached a point where they do not require food, they will not be injured. I have received infested clover roots from Celina, Mercer county, on June 25, that contained an occasional pupa, thus showing that the longer plowing is delayed after this date the greater number of the borers will be left to attack clover fields the following spring, because as I have stated, the pupa requires no food and cutting off the food supply of the grubs will not then affect, in the least, its development.

A PRACTICAL EXPERIMENT IN PREVENTIVE MEASURES.

During June, 1897, a plot of ground about 16x20 feet on the Experiment Station grounds, was sown to red clover. On July 7, 1899, an examination of twenty-five or thirty plants growing on this area revealed many larvæ or grubs of clover root borer, some quite small, others half grown, and some nearly full grown and two pupæ, but no adults. The plot was plowed July 8, the depth of plowing being from four to five inches. The ground, up to this time, had been very dry, too dry, in fact, to plow, and for that reason this was delayed until almost too late, as, on the 17th, two pupæ and one adult were found in clover roots in the field. This shows that the condition of the small patch was about as in the fields, generally.

On August 10th quite a thorough examination was made, by Mr. Mally, with the following result: a single pupa and three nearly full grown larvæ were found in clover roots, two or three inches below the surface, while other larvæ and pupæ were found from four to five inches below the surface of the ground, all in dead and decaying roots. There seemed to be rather less larvæ and pupæ here than before plowing. On August 11th a cage was placed over some of this plowed ground, to prevent the escape of any adults that might develop in the roots underneath. On September 20th digging in the plowed area failed to reveal a single individual, while in the fields there were larvæ or grubs from half to full grown, pupæ and newly developed adults, some of these last being in almost totally decayed roots. On October 19th Mr. Mally dug over nearly half of this plowed plot, examining carefully all clover roots, with the result that four live beetles were found, and the remains of five others. All clover roots were nearly, or quite decayed. In the fields, the beetles were abundant in the roots, even where these were dead, much eaten and decayed; also, there were pupæ and grubs.

What had become of those in the plowed area? There can be but one answer to this. They either perished, or migrated after developing to adults. Now, the beetles do not migrate until spring, and those found in the upturned roots certainly did not do this. It was clearly shown, in the fields, that the beetles remain even in dead and badly eaten and decayed roots until spring, so the killing of the clover roots in the plowed plot would not have driven those that developed to a premature migration. The soil under the cage that had been placed over some of these roots, was examined, together with the roots themselves, but no borers were found. This soil was then thrown into water, which would cause all borers, living or dead, to come to the surface, but none were found. In this case had any developed they could not have escaped. We are, therefore, forced to the conclusion that the plowing of the sod on July 8th resulted in the killing of most of the borers, and that if this had been done earlier, say during the last week in June, the result would have been even more decisive.

The period during which the plowing must be done is a busy one, and especially where wheat is an important crop. But there is seldom a season when there are not some rainy days during hay and wheat harvest; days when neither haying nor harvesting can be done, and it is then that the plows can be started.

It is the object of this bulletin to show what can be accomplished by thus taking advantage of circumstances. There are, however, few years, when, as was the case this year, at Wooster, the sod is too dry to plow at the proper season.

There is no other insect, attacking the clover fields in Ohio, that can be confused with this one, though the fully developed beetles strongly resemble another borer working in the elm and ash, but the two are entirely distinct.

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